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Practitioner's Docket No. U 012593-1

420 Rec'd PCT/PTO 03 FEB 2000

CHAPTER II

**TRANSMITTAL LETTER
TO THE UNITED STATES ELECTED OFFICE (EO/US)**

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

PCT/RU98/00250	3 AUGUST 1998	4 AUGUST 1997
INTERNATIONAL APPLICATION NO. CLAIMED	INTERNATIONAL FILING DATE	PRIORITY DATE

LIQUID CRYSTAL DISPLAY
TITLE OF INVENTION

Pavel Ivanovich LAZAREV; Sergei Vasilievich BELYAEV; Jury Alexandrovich BOBKOV
APPLICANT(S)

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231
ATTENTION: EO/US

NOTE: The completion of those filing requirements that can be made at a time later than 30 months from the priority date results from the Commissioner exercising his judgment under the authority granted under 35 USC 371(d). The filing receipt will show the actual date of receipt of the last item completing the entry into the national phase. See 37 C.F.R. §1.491 which states: "An international application enters the national state when the applicant has filed the documents and fees required by 35 USC 371(c) within the periods set forth in § 1.494 and § 1.495."

CERTIFICATION UNDER 37 C.F.R. 1.10*
(Express Mail label number is **mandatory**.)
(Express Mail certification is optional.)

I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on this date FEBRUARY 3, 2000, in an envelope as "Express Mail Post Office to Addressee," Mailing Label Number EL386267341US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

GERALDINE MARTI

(type or print name of person mailing paper)

Geraldine Marti

Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

***WARNING:** Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. 1.10(b).
"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

(Transmittal Letter to the United States Elected Office (EO/US)—page 1 of 8)

EL3.8 62 67 3 4 1 US

09485168 / 051900
09/485168

420 Rec'd PCT/PTO 03 FEB 2000

WARNING:

Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. §1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing - See 37 C.F.R. §1.8.

NOTE: *Documents and fees must be clearly identified as a submission to enter the national state under 35 USC 371 otherwise the submission will be considered as being made under 35 USC 111. 37 C.F.R. § 1.494(f).*

1. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. 371:

- a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. 371(f)).
- b. ☒ The U.S. National Fee (35 U.S.C. 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

2.Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
[]*	TOTAL CLAIMS	8 - 20 =		x \$ 18.00 =	\$
	INDEPENDENT CLAIMS	1 - 3 =		x \$ 78.00 =	
	MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$260.00				
BASIC FEE**	<input type="checkbox"/> U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO: <input type="checkbox"/> and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(2) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 CFR 1.492(a)(4)) \$96.00 <input type="checkbox"/> and the above requirements are not met (37 CFR 1.492(a)(1)) \$670.00 <input checked="" type="checkbox"/> U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO: <input type="checkbox"/> has been paid (37 CFR 1.492(a)(2)) \$690.00 <input checked="" type="checkbox"/> has not been paid (37 CFR 1.492(a)(3)) \$970.00 <input type="checkbox"/> where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5)) \$840.00				\$970.00
	Total of above Calculations				= \$970.00
SMALL ENTITY	Reduction by ½ for filing by small entity, if applicable. Affidavit must be filed. (note 37 CFR 1.9, 1.27, 1.28)				-
	Subtotal				
	Total National Fee				\$
	Fee for recording the enclosed assignment document \$40.00 (37 CFR 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				
TOTAL	Total Fees enclosed				\$970.00

*See attached Preliminary Amendment Reducing the Number of Claims.

- i. ☒ A check in the amount of \$970.00 to cover the above fees is enclosed.
ii. ☐ Please charge Account No. _____ in the amount of \$ _____.
A duplicate copy of this sheet is enclosed.

****WARNING:** "To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: * * * (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).

WARNING: If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.

3. ☒ A copy of the International application as filed (35 U.S.C. 371(c)(2)):

NOTE: Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.

- a. ☐ is transmitted herewith.
b. ☐ is not required, as the application was filed with the United States Receiving Office.
c. ☒ has been transmitted
i. ☒ by the International Bureau.
Date of mailing of the application (from form PCT/IB/308): _____.
ii. ☐ by applicant on _____.
Date

4. ☒ A translation of the International application into the English language (35 U.S.C. 371(c)(2)):

- a. ☒ is transmitted herewith.
b. ☐ is not required as the application was filed in English.
c. ☐ was previously transmitted by applicant on _____.
Date
d. ☐ will follow.

420 Rec'd PCT/PTO 03 FEB 2000

5. ☒ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. 371(c)(3)):

NOTE: The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.

- a. ☐ are transmitted herewith.
b. ☐ have been transmitted
i. ☐ by the International Bureau.
Date of mailing of the amendment (from form PCT/IB/308): _____
ii. ☐ by applicant on _____
Date
c. ☒ have not been transmitted as
i. ☒ applicant chose not to make amendments under PCT Article 19.
Date of mailing of Search Report (from form PCT/ISA/210): Nov. 18, 1998.
ii. ☐ the time limit for the submission of amendments has not yet expired.
The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.
6. ☒ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. 371(c)(3)):
a. ☐ is transmitted herewith.
b. ☐ is not required as the amendments were made in the English language.
c. ☒ has not been transmitted for reasons indicated at point 5(c) above.
7. ☒ A copy of the international examination report (PCT/IPEA/409)
☒ is transmitted herewith.
☐ is not required as the application was filed with the United States Receiving Office.
8. ☐ Annex(es) to the international preliminary examination report
a. ☐ is/are transmitted herewith.
b. ☐ is/are not required as the application was filed with the United States Receiving Office.
9. ☐ A translation of the annexes to the international preliminary examination report
a. ☐ is transmitted herewith.
b. ☐ is not required as the annexes are in the English language.

420 1634 PCT/PTO 03 FEB 2000

10. ☒ An oath or declaration of the inventor (35 U.S.C. 371(c)(4)) complying with 35 U.S.C. 115,
- a. ☐ was previously submitted by applicant on _____.
Date
- b. ☐ is submitted herewith, and such oath or declaration
- i. ☐ is attached to the application.
- ii. ☐ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. 1.70.
- c. ☒ will follow.

Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):
- a. ☒ is transmitted herewith.
- b. ☐ has been transmitted by the International Bureau.
Date of mailing (from form PCT/IB/308): _____.
- c. ☐ is not required, as the application was searched by the United States International Searching Authority.
- d. ☐ will be transmitted promptly upon request.
- e. ☐ has been submitted by applicant on _____.
Date
12. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98:
- a. ☐ is transmitted herewith.
Also transmitted herewith is/are:
☐ Form PTO-1449 (PTO/SB/08A and 08B).
☐ Copies of citations listed.
- b. ☒ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. 371(c).
- c. ☐ was previously submitted by applicant on _____.
Date
13. ☐ An assignment document is transmitted herewith for recording.

A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

420 Rec'd PCT/PTO 03 FEB 2000

14. ☒ Additional documents:
- a. ☒ Copy of request (PCT/RO/101)
- b. ☒ International Publication No. WO 99/06884
- i. ☒ Specification, claims and drawing
- ii. ☐ Front page only
- c. ☒ Preliminary amendment (37 C.F.R. § 1.121)
- d. ☒ Other

PCT/IB/306, PCT/IB/345, PCT/IPEA/401, PCT/IPEA/416

15. ☒ The above checked items are being transmitted
- a. ☒ before 30 months from any claimed priority date.
- b. ☐ after 30 months.
16. ☐ Certain requirements under 35 U.S.C. 371 were previously submitted by the applicant on _____, namely:
- _____
- _____
- _____

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: *"A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).*

NOTE: *"Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).*

- ☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 12-0425.

☒ 37 C.F.R. 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: *Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.*

☐ 37 C.F.R. 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: *Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must*

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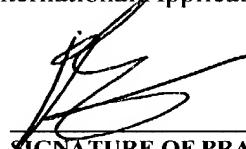
only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

- [X] 37 C.F.R. 1.17 (application processing fees)
- [X] 37 C.F.R. 1.17(a)(1)-(5)(extension fees pursuant to § 1.136(a).
- [X] 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

- [X] 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).



SIGNATURE OF PRACTITIONER

Reg. No.:25,858

Tel. No.: (212) 708-1930

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William R. Evans

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420 Rec'd PCT/PTO 03 FEB 2000
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PCT/RU98/00250	3 AUGUST 1998	4 AUGUST 1997
INT'L APPLICATION NO.	INT'L FILING DATE	PRIORITY DATE CLAIMED

LIQUID CRYSTAL DISPLAY
TITLE OF INVENTION

Pavel Ivanovich **LAZAREV**; Sergei Vasilievich **BELYAEV**; Jury Alexandrovich
BOBKOV
APPLICANT(S)

Attorney Docket: U 012593-1

Commissioner of Patents and Trademarks
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Please amend the above application as follows.

In the Claims

Claim 5, line 1, delete "Claims 1 or 4" and substitute therefor --claim
1--

CERTIFICATION UNDER 37 C.F.R. 1.10*
(Express Mail label number is **mandatory**.)
(Express Mail certification is optional.)

I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on this date February 3, 2000 in an envelope as "Express Mail Post Office to Addressee," Mailing Label Number EL386267341US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

GERALDINE MARTI

(type or print name of person mailing paper)



Signature of person mailing paper

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EL3.86267341US

Claim 6, line 1, delete "Claims 1 or 4" and substitute therefor --claim
1--

Claim 7, line 1, delete "Claims 1 or 3" and substitute therefor --claim
1--

Claim 8, line 1, delete "Claims 1 or 4" and substitute therefor --claim
1--

Please add the following claims

--9. A display of claim 2, wherein a layer containing at least one dye emitting luminescence is mounted on the external side of one of the plates, and the polarizer located on the same plate is placed either on its internal surface or between its external surface and the layer containing at least one dye emitting luminescence.

10. A display of claim 3, wherein a layer containing at least one dye emitting luminescence is mounted on the external side of one of the plates, and the polarizer located on the same plate is placed either on its internal surface or between its external surface and the layer containing at least one dye emitting luminescence.

11. A display of claim 4, wherein a layer containing at least one dye emitting luminescence is mounted on the external side of one of the plates, and the polarizer located on the same plate is placed either on its internal surface or between its external surface and the layer containing at least one dye emitting luminescence.

12. A display of claim 2, wherein a layer containing at least one dye emitting luminescence is located on the internal side of one of plates, the polarizer located on the same plate being placed between the layer containing at least one dye emitting luminescence, and the liquid crystal layer.

13. A display of claim 3, wherein a layer containing at least one dye emitting luminescence is located on the internal side of one of plates, the polarizer located on the same plate being placed between the layer containing at least one dye emitting luminescence, and the liquid crystal layer.

14. A display of claim 4, wherein a layer containing at least one dye emitting luminescence is located on the internal side of one of plates, the polarizer located on the same plate being placed between the layer containing at least one dye emitting luminescence, and the liquid crystal layer.

15. A display of claim 2, wherein a reflector is installed mounted on the internal or the external side of the back surface of the plate, and the layer containing at least one luminescent dye is located between the reflector and the polarizer located on the same plate.

16. A display of claim 3, wherein a reflector is installed mounted on the internal or the external side of the back surface of the plate, and the layer containing at least one luminescent dye is located between the reflector and the polarizer located on the same plate.

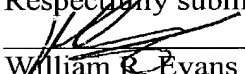
17. A display of claim 2, wherein the layer containing at least one dye emitting luminescence is located on the front plate, and both this layer and the polarizer located on the same plate are implemented as a single polarizing layer containing molecules of at least one dye emitting luminescence, which are homogeneously oriented along at least one molecular axis, with the layer located on either the external or the internal side of the front plate.

18. A display of claim 3, wherein the layer containing at least one dye emitting luminescence is located on the front plate, and both this layer and the polarizer located on the same plate are implemented as a single polarizing layer containing molecules of at least one dye emitting luminescence, which are homogeneously oriented along at least one molecular axis, with the layer located on either the external or the internal side of the front plate.

19. A display of claim 4, wherein the layer containing at least one dye emitting luminescence is located on the front plate, and both this layer and the polarizer located on the same plate are implemented as a single polarizing

layer containing molecules of at least one dye emitting luminescence, which are homogeneously oriented along at least one molecular axis, with the layer located on either the external or the internal side of the front plate.--

Respectfully submitted,



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420 Rec'd PCT/PTO 03 FEB 2000

IPC6 G 02F 1/13

Liquid crystal display

This invention belongs to display units, in particular, to liquid crystal (LC) displays, and can be used in displays and indicators of various purposes, as well as in optical modulators, matrix light modulation systems etc.

Devices implemented as flat cuvettes formed by two parallel glass plates are known, with electrodes made of optically transparent electrically conductive material, e.g. indium or tin dioxide, deposited onto their internal surfaces. Surfaces of the plates along with the electrodes are specially processed, which ensures the required homogeneous orientation of liquid crystal molecules at the plate surfaces and in the bulk of the LC film. When the orientation is homogeneous, the large axes of liquid crystal molecules at the plate surfaces are located parallel to the orientation directions, which are usually chosen mutually perpendicular. After the cuvette is assembled, it is filled with the liquid crystal, which will then form a layer of 5-20 microns thickness. This layer is an active environment varying the optical properties (rotation angle of the polarization plane) under action of an electric field. The change of optical properties is registered in crossed polarizers, which are usually glued onto the external surfaces of the cuvettes [1]. Therefore, the sites of the display at which the electrodes are not subject to voltage are light-transmitting and look bright, while the sites of the display under action of the voltage look as dark areas. To create a color image on the display, a special layer is introduced colored with organic or inorganic dyes, the coloring patterns having the shapes of picture elements (character-generating or electronic-game indicators), or of light filter matrices of RGB or CMY types (matrix screens). The dyes ensure the appropriate coloring of light which is transmitted through the light filter element. The common fault of such type of devices is their low brightness and insufficient color saturation of the obtained image. One of the reasons is the use of dichroic polarizers of light absorbing up to 50-60% of light in the visible range, and, besides, partial absorption of the light flux by the dyes themselves. To achieve high color saturation, high light source brightness is then required, which is bound to increase energy consumption by the display. The increased energy consumption results in loss of advantages of LC displays as highly economical devices in comparison with alternative display units.

The second drawback of the known LC displays is the small viewing angle, since the multilayer design of the LC display allows to effectively control the light flux propagating to the front display surface only within a limited solid angle.

This invention aims to achieve higher brightness, color saturation of the image, and to

increase the viewing angle of LC displays up to 180° by more efficiently utilizing the emission spectrum of the radiation source, in particular, its ultra-violet range.

The invention purpose is achieved by constructing a liquid crystal display containing a layer of liquid crystal placed between the front and the back plates, with at least one electrode and one polarizer located on each of the plates, and a layer containing at least one dye in at least one region, wherein a dye emitting luminescence under action of UV radiation in the range of 400-700 nm, or a mixture of at least one dye emitting luminescence and at least one dye absorbing but not emitting luminescence, is used as at least one of the dyes.

In the general case, the claimed display will be able to work using emission from external sources, for example, sun radiation including that of UV range. However, a radiation source emitting in UV and visible spectral ranges can be included into the display design. It is relevant for the maximum of its emission to be in the range of 200-450 nm. The radiation source can be mounted from the side of either the front or the back plate. It is assumed that the radiation can be directed inside the display through either the front or the back plates using any suitable design, for example, through the front or the lateral surface of the plate.

In this design, the layer containing at least one dye emitting luminescence can be located on the external side of one of the plates, and then the polarizer located on the same plate can be placed either on its internal surface, or between its external surface and the layer containing at least one dye emitting luminescence. So it is essential that the polarizer should in both cases be located between the luminescent layer and the layer of liquid crystal. If the layer containing at least one dye emitting luminescence is located on the internal side of one of the plates, the polarizer located on the same plate should again be placed between the layer containing at least one dye emitting luminescence and the liquid crystal layer.

Apart from the transmissive display described above, the design of the reflective display can be obtained, which also uses the UV part of the source radiation. Then the reflector mounted on either the internal or the external side of the plate can be included into the display, the plate naturally becoming the back plate, because radiation from the source will not pass through it. It is relevant in this case to place the layer containing at least one luminescent dye on the back plate, between the reflector and the polarizer located on the same plate. If molecules of the dye in the layer containing at least one dye emitting luminescence are homogeneously oriented along at least one molecular axis, such a layer will acquire polarizing properties. Therefore, it is possible to place this layer on the front plate, and thus to avoid using a separate polarizer. In this case, the layer emitting luminescence and the polarizer located on the same plate actually turn out to be included into a single polarizing layer containing molecules of at least one dye emitting luminescence, with the molecules homogeneously oriented along at least one molecular axis. This polarizing layer can then be located on either external or internal

side of the front plate.

The basis of the invention is explained by the drawing figures. In Figs. 1-4, LC displays of transmissive type are schematically presented with various locations of polarizers and layers of luminescent dye on the external and the internal sides of LC display plates.

In Figs. 5 and 6, an LC display of reflective type is schematically presented with external and internal location of the polarizers and the luminescent dye layers.

In Fig. 7, a display is schematically presented in which the function of external polarizer is performed by a layer containing a dye emitting luminescence.

The LC display presented in Fig. 1 consists of two plates 1 and 2, which can be made of glass, plastic, or other either rigid or flexible material transparent in both visible and UV spectral regions. On the internal surfaces of these plates which are adjacent to the layer of nematic liquid crystal 3, transparent electrodes 4 and 5 are deposited which can cover plates either with a continuous layer or partially, e.g., as either identical or different elements of any shape. On top of the transparent electrodes 4 and 5, the layers 6 and 7 of polymer or other material are deposited. The surfaces of those layers are made direction-anisotropic by rubbing or otherwise, to maintain orientation of molecules of the liquid crystal. On the external sides of plates, the polarizers 8 and 9 are located transparent in the UV spectral region. From the external side of the polarizer 8, a layer is deposited of one or several luminescent dyes 10 emitting luminescence in different spectral bands in the visible range. To eliminate the undesirable luminescence of the layer 10 caused by UV illumination by outside daylight, an additional layer 13 is deposited on top of the luminescent layer 10, which serves as a filter not transmitting this UV illumination. The radiation emitted by the radiation source, either external or included in the display, is schematically shown with arrows.

In Fig. 2, an LC display is schematically shown in which the layer of luminescent dyes is located on the polarizer at the back side of the display. Then, both the polarizer and the plates are transparent in the visible range of the spectrum, and do not transmit its UV part.

In Fig. 3, the design of the display is presented with the polarizers 8 and 9 and the layer of luminescent dyes 10 is located inside the LC display. The two polarizers, each having the form of a thin layer of homogeneously oriented dye molecules, are deposited onto a sublayer 11 separating the transparent electrode 4 from the polarizing layer 8 (front plate 1), and onto the surface of the luminescent dye layer 10, which is placed directly on the transparent electrodes 5 of the back plate 2. The polarizing layers in this embodiment are effective in the visible spectral range and are not transparent in the UV range. The material of the top plate 1 can be opaque in the UV range, but the plates 2 need to be transparent in both visible and UV spectral ranges.

In Fig. 4, another embodiment of the transmissive LC display with internal location of optical elements is shown, in which the layer of luminescent dyes 10 is located on the internal side of the top (front) plate 1. Then the polarizing layers 8 and 9 should be effective only in the UV spectral range, and requirements to optical properties of the plates 1 and 2 are the same as those of the previous embodiment. It is obvious that the matrices of luminescent dyes in Figures 3 and 4 can be placed on the external sides of the appropriate plates. Then, both plates should be transparent either in the visible spectral range only (Fig.3), or in both visible and UV ranges (a version of Fig.4).

In the reflective embodiment of the LC display, the polarizer, the layer of dyes emitting luminescence, and the reflector can also be placed either on the external or on the internal side of the back plate 2. In Fig.5, the design is shown of the display with external location of the polarizer, the layer emitting luminescence, and the diffuse reflector. In this case, both polarizers 8 and 9 are placed on the external sides of the plates 1 and 2. The layer of luminescent dyes 10 is then placed between the polarizer 9 and the reflector 12. The polarizers 8 and 9 and the plates 1 and 2 should be transparent in both UV and visible spectral ranges.

When the location of the optical elements is internal (Fig.6), the reflector 12 is first formed on the plate 2. Then, a matrix of the layer emitting luminescence 10, and the polarizer 9 on its top, are formed. This plate can be made either from either a transparent or an opaque material, for example, of crystalline silicon. A diffusely reflecting layer is formed on the plate, which becomes the reflector 12. The diffusely reflecting layer can be obtained by depositing a polymer film onto an aluminium mirror, the film containing particles of either arbitrary or definite shapes and sizes, with the refraction index different from that of the polymer. Other methods of obtaining the diffusely reflecting layer include depositing a polymer film containing a suspension of aluminium powder or other material efficiently reflecting light, or creating an embossment on the surface of the plate onto which the reflecting layer 12 will then be deposited, for example, an aluminium film. The embossment can be formed by processing a surface by an abrasive material, etching, impression, depositing a polymeric film containing particles of definite shapes and sizes, or by selectively etching, through a mask, either the plate surface itself, or a film of polymer or other material deposited onto it. The aluminium film can at the same time serve as a continuous electrode. By etching a narrow strip of aluminium along a fixed outline 10-100 microns wide using photo-lithography, it is possible to obtain electrodes of the necessary configuration, for example, a rectangular matrix of electrodes for flat matrix displays screens, while maintaining the common reflective background over the entire working field of the indicator. The layer emitting luminescence 10 is deposited directly onto the reflecting coating or onto a sublayer, which is formed on the reflector. The polarizing layer is deposited either directly onto the layer of dyes emitting luminescence 10, or onto a smoothing sublayer, which is formed on the luminescent layer.

If the reflecting layer, for any reasons, cannot be used as the electrode, or it is made of a non-conducting material, the electrodes should be deposited onto an insulating sublayer, or directly onto the reflector. It is possible to use polymeric film, aluminium oxide, silicon oxide, or other dielectric materials as the insulating layer material. Then, the layer emitting luminescence can be deposited on both the reflector and the electrodes.

The layer containing the dye emitting luminescence can be made using either a single phosphor or a mixture of phosphors. Then, the layer can be made either homogeneous over the whole area, or to have at least some sites containing at least one phosphor. For example, the layer can be a matrix with rectangular elements (sites). Besides, different sites can have either an identical color, or can be implemented in different colors, i.e. can be manufactured using different phosphors.

In Fig.7, a design of the display is presented, in which the function of the external polarizer is performed by a layer 10 containing homogeneously oriented molecules of a dye emitting luminescence. Then the layer emitting luminescence will acquire polarizing properties.

The proposed designs of the LC display can be implemented using twist, supertwist, or smectic LC structures, with various schemes of controlling the character-synthesizing elements or the screen scan. As the luminescent dyes, organic or inorganic phosphors can be used emitting luminescence in the solid state or in a polymeric matrix, in the visible spectral range of 400-700 nm under action of UV-range radiation in the range of 200-450 nm.

To improve color saturation, the entire colored layer as well as its individual sites, for example, color matrix elements or picture elements, can be manufactured from either a mixture of dyes emitting luminescence and the usual dyes absorbing in the visible range, or by depositing them level-by-level. Then, the color of radiation emitted by the phosphor and the range of dye absorption should be selected so as to ensure the largest color saturation and brightness of the image. For the level-by-level deposition, the layer of absorbing dye can be located either inside or outside of the display, with properly coordinated arrangement of the elements.

To obtain an oriented layer of luminescent dyes, a polymeric film can be used, for example, a polyvinyl alcohol film colored with organic phosphors and then stretched. The molecules of phosphor can also be made water-soluble by binding them to ionogenic groups. That will allow to transfer the solution of phosphor molecules to the liquid crystalline mesophase, and to orient them in a thin layer along, at least, one of molecular axes using mechanical shift, oriented substrate surface, or external electromagnetic fields.

A color matrix or picture can be made by consecutive thermal deposition of dyes, either through a mask or by other methods, by selectively coloring a polymer layer with the

appropriate dye, or by depositing a dye layer using either stenciling or other printing methods.

Depending on the design of the display and the used dyes, the used polarizer should have the appropriate optical properties. In some designs, it can be effective only in the visible band of the spectral range while not transmitting UV radiation, in others – to transmit in both UV and visible ranges, or transmitting only in the UV range but not in the visible spectral range. As such polarizers, stretched polymeric films can be used with the molecules absorbing radiation in the UV spectral range introduced into them, as well as polarizing layers which have been obtained on the basis of the liquid crystalline states of substances whose molecules absorb radiation of the UV spectral range. Such polarizing layers can be made by one of the known techniques [2-4]. In particular, they can be based on specific organic dyes, whose solutions can form lyotropic LC states [5]. In addition, they can perform the function of the focusing layer for the liquid crystal. To obtain a polarizer effective only in the UV range of the spectrum while not transmitting the visible part, a polarizer can be used working in the UV and visible ranges, or only in the UV range, but transmitting the visible part of the spectrum without polarization, together with an optical filter excluding the visible part of the spectral range. Such a filter can be implemented by adding the appropriate organic or inorganic dye to the material composition of the display plates, or by depositing, in the appropriate location, an isotropic layer of dye or a polymer film colored with dye absorbing light in the visible spectral range, or, if a film of oriented dye is used as the polarizer, by introducing the appropriate dye into the polarizer material or the polarizing layer. When the filter is manufactured in the form of an absorbing isotropic layer, it can be placed anywhere in the device between the layer containing the luminescent dyes and the light source.

A variety of radiation source types can be used for both visible and UV spectral ranges including gas discharge lamps with mercury, hydrogen, or xenon fillings, plasma and laser light sources, arc discharge etc. Then the source of radiation can either be directly included into the claimed device composing a combined design, or to be comprised in the devices in which the claimed liquid crystal device is used. For example, if it is used as a modulator, the radiation source can be included into the design of the device in which this modulator is used.

Consider the principle of operation of the LC display with a layer emitting luminescence using the transmissive embodiment of the LC display based on a nematic twirled to 90° (Fig. 1) as an example. A flux of non-polarized UV radiation falls onto the display from the side of the second (back) plate 2. After passing through the polarizer 9, which transmits only the UV part of radiation, the radiation becomes polarized, and passes through the plate 2, the transparent electrode 5, and the focusing layer 7. If no voltage is applied to the electrodes, the polarized light is transmitted through the liquid crystal layer 3, which rotates the polarization plane by 90° , and then is transmitted, without

attenuation, through the focusing layer 6, the transparent electrode 4, the plate 1, the UV polarizer 8, and reaches the luminescent dye layer 10 causing it to emit luminescence. When voltage is applied to the electrodes, the twirled form of the nematic transforms, under the action of electric field, into the homeotropic form, in which the optical axis of the nematic is oriented perpendicularly to the planes of plates 1 and 2, and the nematic no longer rotates the light polarization plane for the light passing through it. This means that, when light passes through the layer of nematic, the directions of the light polarization plane set by the polarizer 9 will not change, and will be perpendicular to the polarization direction of the second polarizer 8 when leaving the nematic 3. When the light passes through the polarizer 8, it is absorbed, and does not cause luminescence in the next layer 10. Then, this area will look dark when sight-checked. In the areas of the display containing no electrodes, the twirled form of nematic will always be preserved, and these areas will always emit i.e. look bright. By placing the layer emitting luminescence on the external surface of the display, contrast of the image is made independent of the observation angle, since the flux of light forming the image will be emitted by the external surface of the display, and will not transmit through its light-transforming layers (the liquid crystals and the polarizer).

When the layer of luminescent dyes is placed on the back side of the display (Fig.2), i.e. on the external surface of the plate 2, the flux of UV radiation will be transformed by the layer emitting luminescence into visible-range light. Further propagation of the latter light through the LC display and the control principle remains the same as in the usual LC display. To use the visible part of emission spectrum, it is possible to introduce additional dyes into the layer of luminescent dyes absorbing in the visible spectral range complementary to the emission spectrum of the luminescent dyes. The layer of absorbing dyes with the element arrangement correlated with that of the appropriate elements of the layer of luminescent dyes can be located on the internal surface of the display's plate 2.

The operation principle of the transmissive-type display with the internal location of the polarizer and the luminescent matrix (Fig.3 and 4) remains the same as for the external location of elements. When the layer of luminescent dyes is located on the front plate 1 (Fig.4), the UV radiation passes through the back plate 2, the transparent electrode 5, the insulating layer 11, and the polarizer 9 working in the UV range. Then the light it passes through it, with or without 90° rotation of the polarization plane, depending on the state of the liquid crystal in the layer 3. If the polarization plane has been rotated (opened state), light passes, without absorption, through the second polarizer 8, and falls onto the layer emitting luminescence 10 bringing about luminescence of the appropriate elements of the matrix. The visible light that has been emitted leaves the limits of the display through the transparent electrode 4 and the plate 1. In the closed state, the UV radiation is absorbed by the polarizer 8, and luminescence of the luminescent matrix does not arise. This causes the display or the appropriate matrix elements to become dark.

In the reflective embodiment of the display (Fig.5), light passes through the polarizer 8 transparent in UV and visible range, and becomes polarized by it in both UV and visible ranges. Further, the light passes through the plate 1, the transparent electrode 4, and the focusing layer 6. In the opened state, light passes through the layer of liquid crystal 3 rotating the polarization plane by 90° , through the focusing layer 7, the transparent electrode 5, the plate 2 and, without absorption, the polarizer 9. Then, part of light is absorbed by the luminescent dye of the layer 10, becoming transformed to visible light. The remaining part of the light is reflected from the reflector 12, and again passes through the layer of luminescent dyes, becoming additionally transformed to visible light. The emitted visible-range light is polarized by the polarizer 9, passes through the plate 2, the transparent electrode 5, the focusing layer 7, the liquid crystal layer 3 rotating the polarization plane, and leaves unhindered through the remaining layers and the polarizer 8. When the state of the LC layer is closed, so it does not rotate the polarization plane of the passing light, the light in both UV and visible ranges is absorbed by the second polarizer 9. This prevents the luminescent dyes in the layer 10 from radiating light, and the display looks dark. To avoid weakening color saturation of luminescent light by the visible range light, it is possible to introduce the appropriate absorbing dyes into the layer of dyes emitting luminescence, as described above for the transmissive embodiment of the display.

The principle of operation of the reflective display with an internally located polarizer and the layer of luminescent dyes (Fig.6) does not essentially differ from the previous case.

In case of the display with an oriented layer of luminescent dyes (Fig.7), when the liquid crystal is in the twirled nematic state, the polarized UV radiation passes through all the layers of the display, with the polarization plane rotated by 90° , and leaves, without absorption, through the phosphor layer. To prevent UV light from reaching the eyes of the observer, the layer of luminescent dyes is covered with the filter 13 absorbing UV radiation and transmitting the visible spectral range. When the liquid crystal 3 is not in the twirled state, the UV radiation polarized by the polarizer 9 passes through the display without changes in polarization, and becomes absorbed by the layer of oriented phosphor molecules causing light emission in the visible spectral range. It is obvious that, using the same principle of operation, it is possible to construct a display with the layer of oriented phosphor molecules located on the first plate, but inside the display.

For both transmissive and reflective displays types, intermediate embodiments are possible with varying locations of the polarizer and the luminescent dye matrix layer. Thus, for example, in the transmissive-type displays in Fig.1 and Fig.4, it is possible to position the polarizers inside the displays, while the layer containing the dye emitting luminescence will be placed on the external side of the plate 1. Similar arrangement can be implemented in embodiments of Fig.2 and 3, and Fig.5 and 6.

An essential feature of this invention is that the devices used for manufacturing LC

devices are including a wider device class than the one described above. Besides, the light source used should preferably have a maximum of the emission spectrum in the 200-450 nm range. The polarizers used should be effective in both visible and UV spectral ranges, and layers should contain luminescent dyes transforming UV into visible radiation. This allows to more efficiently use energy of the sources emitting in both UV and visible spectral ranges.

Claims

1. A liquid crystal display containing a layer of liquid crystal placed between the front and the back plates, with at least one electrode and one polarizer attached to each of the plates, and a layer containing at least one dye in at least on one area, wherein either a dye emitting luminescence under action of UV radiation in the 400-700 nm band, or a mixture of at least one dye emitting luminescence and at least one absorbing dye, is used as at least of one of the dyes.
2. A display of Claim 1, wherein a source of radiation is introduced emitting in UV and visible spectral ranges, with an emission maximum in the range of 200-450 nm.
3. A display of Claim 2, wherein a radiation source is mounted from the front panel side.
4. A display of Claim 2, wherein a source of radiation is mounted from the back panel side.
5. A display of Claims 1 or 4, wherein a layer containing at least one dye emitting luminescence is mounted on the external side of one of the plates, and the polarizer located on the same plate is placed either on its internal surface, or between its external surface and the layer containing at least one dye emitting luminescence.
6. A display of Claims 1 or 4, wherein a layer containing at least one dye emitting luminescence is located on the internal side of one of plates, the polarizer located on the same plate being placed between the layer containing at least one dye emitting luminescence, and the liquid crystal layer.
7. A display of Claims 1 or 3, wherein a reflector is installed mounted on the internal or the external side of the back surface of the plate, and the layer containing at least one luminescent dye is located between the reflector and the polarizer located on the same plate.
8. A display of Claims 1 or 4, wherein the layer containing at least one dye emitting luminescence is located on the front plate, and both this layer and the polarizer located on the same plate are implemented as a single polarizing layer containing molecules of

at least one dye emitting luminescence, which are homogeneously oriented along at least one molecular axis, with the layer located on either the external or the internal side of the front plate.

Sources of information referred to while drawing up the application

1. USA Patent No 5,528,398, Cl.359-68, published in 1996. — the prototype
2. USA Patent No 2,400,877, Cl. 350-155, published in 1946.
3. Japan Patent No. 1-183602 (A), G02B 5/30, G02B 1/08, published in 1989.
4. USA Patent No 3,941,901, Cl. 350-160, published in 1976.
5. Application PCT/US 94/05493, published in 08.12.94.

Abstract

The invention belongs to display units, in particular, to liquid crystal (LC) displays, and can be used in display/indicator equipment of various purposes, as well as in optical modulators, matrix systems for light modulation, etc. A liquid crystal display is proposed containing a layer of liquid crystal placed between the front and the back plates, with one electrode and one polarizer located on each of the plates, and a layer containing a dye. As the latter dye, either a single dye emitting luminescence under action of UV radiation in the range of 400-700 nm, or a mixture of one dye emitting luminescence and one absorbing dye, is used. The purpose of the invention is to achieve greater brightness and color saturation of the image, and to increase the viewing angle of LC displays up to 180° by more effectively utilizing the emission spectrum of the radiation source, in particular, its ultra-violet band.

7 formulas, 7 illustrations.

РСТ

ВСЕМИРНАЯ ОРГАНИЗАЦИЯ
ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ
Международное бюро

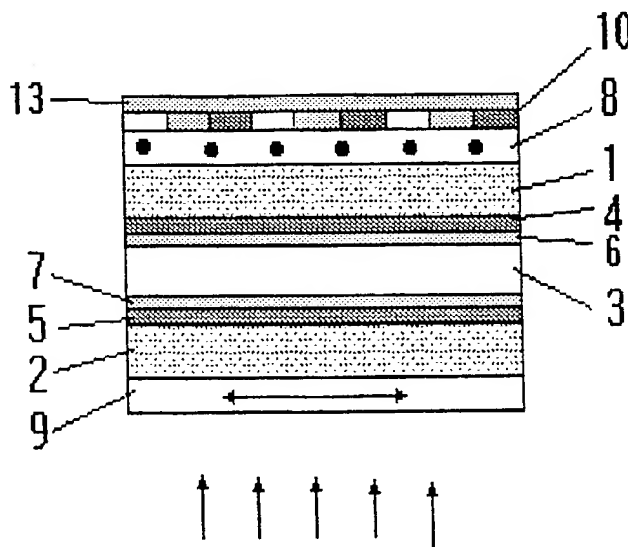


МЕЖДУНАРОДНАЯ ЗАЯВКА, ОПУБЛИКОВАННАЯ В СООТВЕТСТВИИ
С ДОГОВОРом О ПАТЕНТНОЙ КООПЕРАЦИИ (РСТ)

<p>(51) Международная классификация изобретения⁶: G02F 1/1335, 1/13</p>	<p>A1</p>	<p>(11) Номер международной публикации: WO 99/06884 (43) Дата международной публикации: 11 февраля 1999 (11.02.99)</p>
<p>(21) Номер международной заявки: PCT/RU98/00250 (22) Дата международной подачи: 3 августа 1998 (03.08.98) (30) Данные о приоритете: 97113277 4 августа 1997 (04.08.97) RU (71) Заявитель (для всех указанных государств, кроме US): OPTIVA, INC. [US/US]; 1670 South Amphlett Boulevard., Suite 214, San Mateo, CA 94402 (US). (72) Изобретатель; и (75) Изобретатель / Заявитель (только для US): ЛАЗАРЕВ Павел Иванович [RU/RU]; 119633, Москва, ул. Новоорловская, д. 12, кв. 160 (RU) LAZAREV, Pavel Ivanovich, Moscow (RU)].</p>		<p>(81) Указанные государства: CA, CN, JP, KR, US, европейский патент (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Опубликована С отчётом о международном поиске.</p>

(54) Title: LIQUID CRYSTAL DISPLAY

(54) Название изобретения: ЖИДКОКРИСТАЛЛИЧЕСКИЙ ДИСПЛЕЙ



(57) Abstract

The present invention relates to devices for displaying information and more precisely to liquid crystal displays (LCD), wherein said invention may be used in indication systems for various purposes as well as in optical modulators, light-modulation matrix systems, etc. The liquid crystal display of the present invention comprises a liquid crystal layer which is located between a front and a rear plate each bearing an electrode and a polariser. The display also comprises a dye-containing layer that includes a dye which is luminescent under the action of UV radiation at a wavelength of between 400 and 700 nm or a mixture of a luminescent dye and an absorbing dye. This invention provides better brightness and colour saturation of the image as well as a greater angle of vision of the LCD display as far as 180° thanks to the more efficient use of the radiation spectrum from a radiation source, particularly in the ultraviolet range.

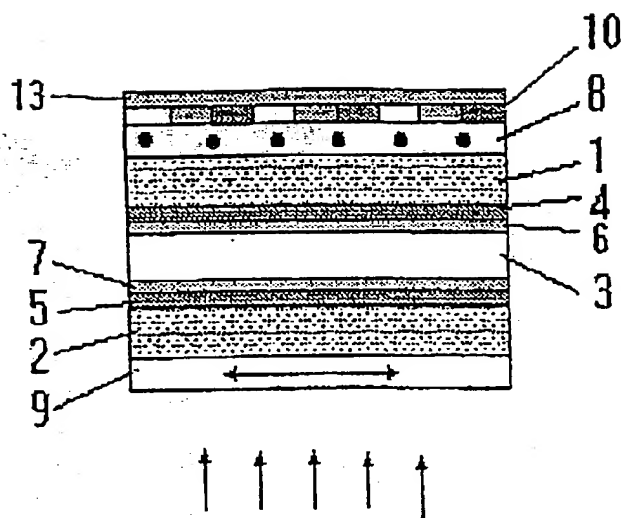


FIG. 1

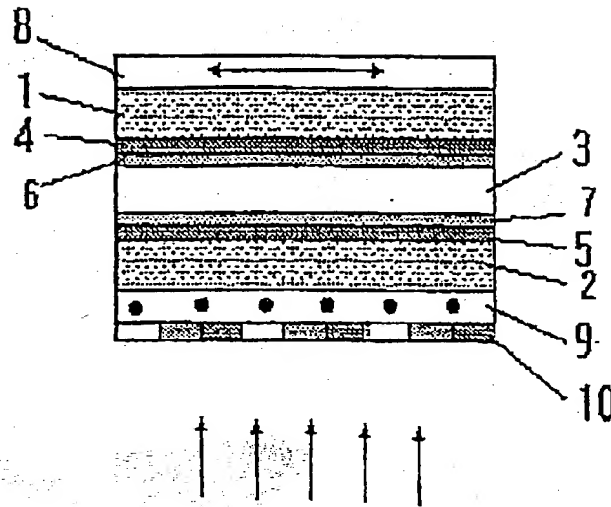


FIG. 2

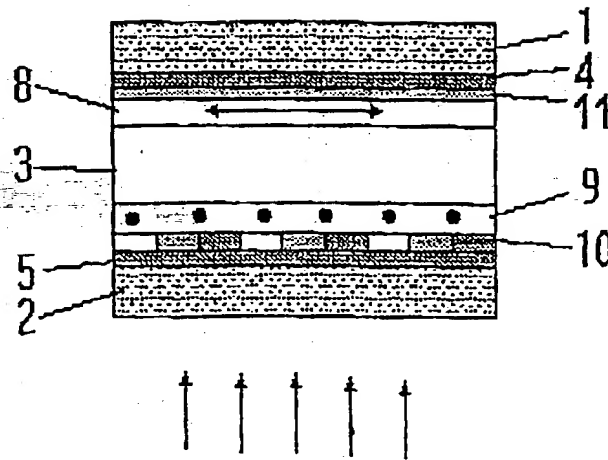


FIG. 3

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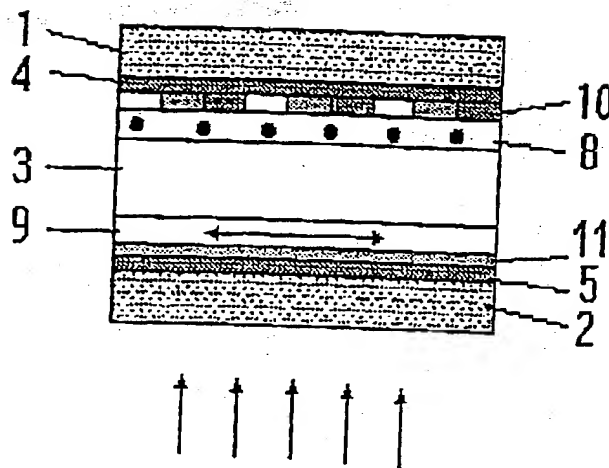


FIG. 4

WO 99/06884

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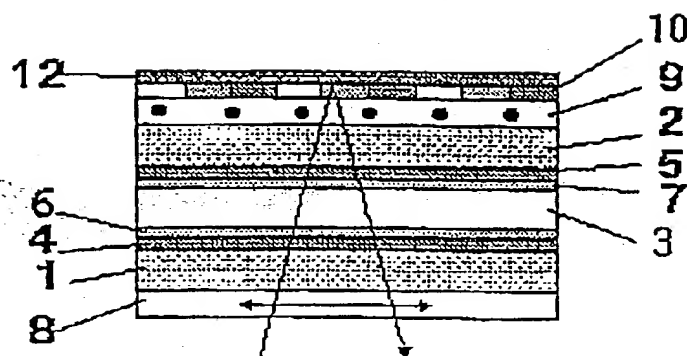


FIG. 5

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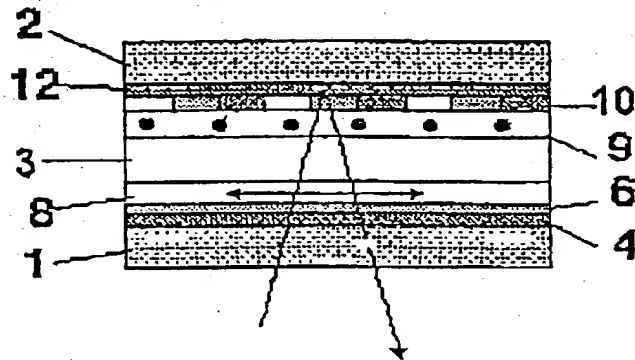


FIG. 6

WO 99/06884

PCT/RU98/00250

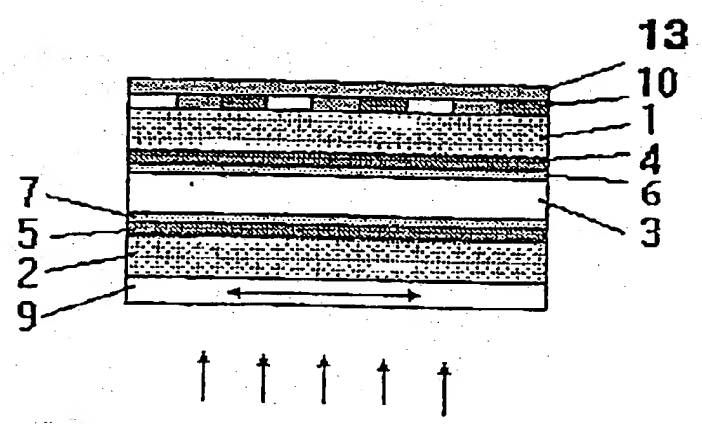


FIG. 7

Practitioner's Docket No. U 012593-1**PATENT****COMBINED DECLARATION AND POWER OF ATTORNEY**(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL,
CONTINUATION, OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

- ☒ original.
☐ design.
☐ supplemental.

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- ☒ national stage of PCT.

NOTE: If one of the following 3 items apply, then complete and also attach **ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.**

NOTE: See 37 C.F.R. § 1.63(d) (continued prosecution application) for use of a prior nonprovisional application declaration in the continuation or divisional application being filed on behalf of the same or fewer of the inventors named in the prior application.

- ☐ divisional.
☐ continuation.

NOTE: Where an application discloses and claims subject matter not disclosed in the prior application, or a continuation or divisional application names an inventor not named in the prior application, a continuation-in-part application must be filed under 37 C.F.R. § 1.53(b) (application filing requirements-nonprovisional application).

- ☐ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION
LIQUID CRYSTAL DISPLAY

SPECIFICATION IDENTIFICATION

The specification of which:

(complete (a), (b), or (c))

(a) ☐ is attached hereto.

NOTE: "The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 C.F.R. § 1.63:

"(1) name of inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;

"(2) name of inventor(s), and attorney docket number which was on the specification as filed; or

"(3) name of inventor(s), and title which was on the specification as filed."

Notice of July 13, 1995 (1177 O.G. 60).

(b) ☐ was filed on _____, ☐ as Application No. _____
☐ and was amended on _____ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 C.F.R. § 1.67.

NOTE: "The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 C.F.R. § 1.63:

"(1) name of inventor(s), and application number (consisting of the series code and the serial number; e.g., 08/123,456);

"(2) name of inventor(s), serial number and filing date;

"(3) name of inventor(s) and attorney docket number which was on the specification as filed;

"(4) name of inventor(s), title which was on the specification as filed and filing date;

"(5) name of inventor(s), title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or

"(6) name of inventor(s), title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number; e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration."

Notice of July 13, 1995 (1177 O.G. 60), M.P.E.P. § 601(a), 6th ed., rev.3.

- (c) ☒ was described and claimed in PCT International Application No. RU 98/00250 filed on 03.08.1998 and as amended under PCT Article 19 on _____ (if any).

SUPPLEMENTAL DECLARATION (37 C.F.R. § 1.67(b))

(complete the following where a supplemental declaration is being submitted)

☐ I hereby declare that the subject matter of the

☐ attached amendment

☐ amendment filed on _____.

was part of my/our invention and was invented before the filing date of the original application, above identified, for such invention.

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

☐ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 C.F.R. § 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

NOTE: "The claim to priority need be in no special form and may be made by the attorney or agent if the foreign application is referred to in the oath or declaration as required by § 1.63. The claim for priority and the certified copy of the foreign application specified in 35 U.S.C. § 119(b) must be filed in the case of an interference (§ 1.630), when necessary to overcome the date of a reference relied upon by the examiner, when specifically required by the examiner, and in all other situations, before the patent is granted. If the claim for priority or the certified copy of the foreign application is filed after the date the issue fee is paid, it must be accompanied by a petition requesting entry and by the fee set forth in § 1.17(i). If the certified copy is not in the English language, a translation need not be filed except in the case of interference; or when necessary to overcome the date of a reference relied upon by the examiner; or when specifically required by the examiner, in which event an English language translation must be filed together with a statement that the translation of the certified copy is accurate." 37 C.F.R. § 1.55(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

- (d) ☐ no such applications have been filed.
 (e) ☐ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

**PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
 (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION
 AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)**

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING DAY, MONTH, YEAR	PRIORITY CLAIMED UNDER 35 USC 119
Russia	97113277	04.08.97	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(35 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER

FILING DATE

_____/_____
_____/_____
_____/_____

CLAIM FOR BENEFIT OF EARLIER U.S./PCT APPLICATION(S)
UNDER 35 U.S.C. § 120

- [] The claim for the benefit of any such applications are set forth in the attached
ADDED PAGES TO COMBINED DECLARATION AND POWER OF
ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-
IN-PART (C-I-P) APPLICATION.

ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

NOTE: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

(list name and registration number)

JOSEPH H. HANDELMAN, 26179

JOHN RICHARDS, 31053

RICHARD J. STREIT, 25765

PETER D. GALLOWAY, 27885

IAN C. BAILLIE, 24090

THOMAS F. PETERSON, 24790

RICHARD P. BERG, 28145

JULIAN H. COHEN, 20302

WILLIAM R. EVANS, 25858

JANET I. CORD, 33778

CLIFFORD J. MASS, 30086

CYNTHIA R. MILLER, 34678

(Check the following item, if applicable)

- ☐ I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.
- ☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

Ladas & Parry
26 West 61st Street
New York, N.Y. 10023

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

Full name of sole or first inventor

Pavel Ivanovich Lazarev
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)

Inventor's signature Pavel Ivanovich Lazarev

Date 02.02.2000 Country of Citizenship Russia

Residence Moscow, Russia

Post Office Address Russia, Moscow, ulitsa Novoorlovskaya, d.12, kv.160

Full name of second joint inventor, if any

Sergei Vasilievich Belyaev
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)

Inventor's signature _____

Date _____ Country of Citizenship Russia

Residence Moskovskaya oblast, Dolgoprudny, Russia

Post Office Address Russia, Moskovskaya oblast, Dolgoprudny, prospekt Patsaeva, d.14, kv.7726

Full name of third joint inventor, if any

Jury Alexandrovich Bobrov
(GIVEN NAME) (MIDDLE INITIAL OR NAME) FAMILY (OR LAST NAME)

Inventor's signature Jury Alexandrovich Bobrov

Date 02.02.2000 Country of Citizenship Russia

Residence Moscow, Russia

Post Office Address Russia, Moscow, 103575, K-575, 906-128

*(check proper box(es) for any of the following added page(s)
that form a part of this declaration)*

☐ **Signature** for fourth and subsequent joint inventors. *Number of pages added* _____

* * *

☐ **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added* _____

* * *

☐ **Signature** for inventor who refuses to sign or cannot be reached by person authorized under 37 C.F.R. § 1.47. *Number of pages added* _____

* * *

☐ Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 C.F.R. § 1.47)

* * *

☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.

☐ Number of pages added _____

* * *

☐ Authorization of practitioner(s) to accept and follow instructions from representative.

*(If no further pages form a part of this Declaration,
then end this Declaration with this page and check the following item)*

☒ This declaration ends with this page.

Practitioner's Docket No. U 012593-1**PATENT****IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

[x] In re application of: Pavel Ivanovich LAZAREV et al.

Application No.: PCT/RU98/00250

Group No.:

Filed: August 3, 1998

Examiner:

For: LIQUID CRYSTAL DISPLAY

[] *Patent No.:

Issue Date:

*NOTE: Insert name(s) of inventor(s) and title also for patent Where statement is with respect to a maintenance fee payment, also insert application number and filing date, and add Box M. Fee to address.

STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(c-f) and 1.27(b-d))

With respect to the invention described in

[] the specification filed herewith.

[] application no. _____, filed _____.

[] patent no. _____ issued _____.

I. IDENTIFICATION AND RIGHTS AS A SMALL ENTITY

I hereby state that I am

(complete either (a), (b), (c) or (d) below)

(a) Independent Inventor

[] a below named independent inventor, and that I qualify as an independent inventor, as defined in 37 CFR 1.9(c), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office.

(b) Noninventor Supporting a Claim by Another

[] making this statement to support a claim by

for a small entity status for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code. I hereby state that I would qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, if I had made the above identified invention.

(c) Small Business Concern

[] the owner of the small business concern identified below:

[x] an official of the small business concern empowered to act on behalf of the concern identified below:

Name of Concern OPTIVA, INC.

Address of Concern 1670 South Amphlett Blvd., Suite 214, San Mateo,
CA 94402, USA and

that the above identified small business concern qualifies as a small business concern, as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

(d) Non-Profit Organization

☐ an official empowered to act on behalf of the nonprofit organization identified below:

Name of Organization _____

Address of Organization _____

TYPE OF ORGANIZATION

- ☐ University or Other Institution of Higher Education
☐ Tax Exempt Under Internal Revenue Service Code (26 USC 501(a) and 501(c) (3))

☐ Nonprofit Scientific or Educational Under Statute of State of the United States of America

(Name of State _____)

(Citation of Statute _____)

☐ Would Qualify as Tax Exempt Under Internal Revenue Service Code (26 USC 501(a) and 501(c) (3)), if Located in the United States of America

☐ Would Qualify as Nonprofit Scientific or Educational Under Statute of State of the United States of America, if Located in the United States of America

(Name of State _____)

(Citation of Statute _____)

and that the nonprofit organization identified above qualifies as a nonprofit organization, as defined in 37 CFR 1.9(e), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code.

II. OWNERSHIP OF INVENTION BY DECLARANT

I hereby state that rights under contract or law remain with and/or have been conveyed to the above identified

☐ person
 (item (a) or (b) above)

☒ concern
 (item (c) above)

☐ organization
 (item (d) above)

EXCEPT, that if the rights held are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held (1) by any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, (2) any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or (3) a nonprofit organization under 37 CFR 1.9(e).

- ☒ no such person, concern, or organization
☐ person, concerns or organizations listed below*

*NOTE: Separate statements are required from each named person, concern or organization having rights to the invention as to their status as small entities. (37 CFR 1.27)

Full Name _____
 Address _____
☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

Full Name _____
 Address _____
☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

III. ACKNOWLEDGEMENT OF DUTY TO NOTIFY PTO OF STATUS CHANGE

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

IV. DECLARATION

(check the following item, if desired)

NOTE: The following verification statement need not be made in accordance with the rules published on October 10, 1997, 62 Fed. Reg. 52131, effective December 1, 1997.

NOTE: "The presentation to the Office (whether by signing, filing, submitting, or later advocating) of any paper by a party, whether a practitioner or non-practitioner, constitutes a certification under § 10.18(b) of this chapter. Violations of § 10.18(b)(2) of this chapter by a party, whether a practitioner or non-practitioner, may result in the imposition of sanctions under § 10.18(c) of this chapter. Any practitioner violating § 10.18(b) may also be subject to disciplinary action. See §§ 10.18(d) and 10.23(c)(15)." 37 CFR 1.4(d)(2).

- ☐ I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

V. SIGNATURES*(complete only (e) or (f) below)***(e)****NOTE:** All inventors must sign the statement._____
Name of Inventor

Date: _____

Signature of Inventor_____
Name of Inventor

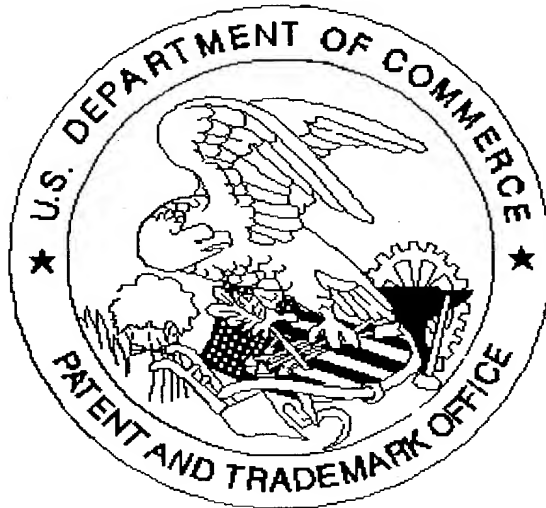
Date: _____

Signature of Inventor_____
Name of Inventor

Date: _____

Signature of Inventor*(add lines for any additional inventors who must sign)***or****(f)****NOTE:** The title of the person signing on behalf of a concern or nonprofit organization should be specified.Name of Person Signing LAZAREV Pavel IvanovichTitle of Person Chairman of Board of Directors*(if signing on behalf of a concern or non-profit organization)*Address of Person Signing ul. Novoorlovskaya, d.12, kv.160Moscow, 119633, RussiaSIGNATURE  DATE 01.02.2000

United States Patent & Trademark Office
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Application deficiencies found during scanning:

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*A specification pages have
a line in through them.*